

son; but it goes without saying that he does not want all this printed. A judicious selection from these 734 letters would have been very much more valuable than this unsifted mass of important and unimportant matter. There is an excellent index, which will be of great use to a reader desirous of referring to any particular subject. In an appendix are given some letters about the negotiations to get Gauss an appointment at Berlin, and three very interesting letters from Bessel to Olbers from the year 1812, which have only recently been found.

J. L. E. D.

COLONIAL FRUIT-GROWING.

Fruit-ranching in British Columbia. By J. T. Bealby. Pp. viii + 196. (London: A. and C. Black, 1909.) Price 3s. 6d. net.

THIS is a practical work on the subject of fruit-growing in British Columbia, and we recommend it to any who have the intention of emigrating for the purpose of engaging in this healthful and interesting pursuit. But not to these alone, for the style in which it is written is sufficiently good to make the reading agreeable to the general public. It sets forth in plain but picturesque language the reasons that led the rancher to select British Columbia for the scene of his operations; it describes his journey out, relates the difficulties the new settler had to overcome, and proceeds to describe the measure of success that soon attended his labours.

This success enabled him, not only to win prizes for fruit at exhibitions in British Columbia and in the United States, but also to send excellent apples to the Royal Horticultural Society's shows in London, and gain for them the Society's gold medal!

The figures relating to the crops obtainable per acre in British Columbia are almost bewildering to the cultivator in this country, who can never be certain, even of a moderate return, until the danger of spring frosts is past at the end of May. The difference is explained by the sunnier skies, freedom from violent winds and storms, and the presence of a most fertile soil. The allurements these things offer are only to those who are content to undertake the hard work inseparable from colonisation. Unless the "tender-foot" possesses a sufficient capital to enable him to purchase an estate already planted, he must commence by clearing away the trees and under-shrub from his plot, and in this and all other work he must improvise ways and means for carrying out the details which are simple enough in a more thickly populated country, but very difficult in parts of a colony in the first stages of development.

In these matters the reader will find much interesting information in Mr. Bealby's work. He will realise how important it is that the work of preparing the ground shall be done in a thorough manner, and that careful consideration shall be given to the planting of suitable trees. The settler has to take into account the kinds of fruit most likely to yield profitable returns, and having decided thus far he must select the best varieties of each kind. He must study his market, the means that exist for sending the fruits to market, and the length of time they will be on transit.

The advice given on such matters as these is perfectly sound, and therefore calculated to assist settlers very materially, provided that instead of slavishly following them in detail they wisely modify them to suit best their own circumstances.

Mr. Bealby probably underestimates the cost of preparing the land, but this may be expected to vary in different districts, and he appears to place too much importance upon the fact that in the Kootenay and Okanagan districts the fruit plantations are more free from insect and fungal pests than in other localities. The explanation of this comparative immunity will probably be found in the newness of the land. Pests are seldom epidemic unless the host-plants are present in large numbers and so facilitate the spread of insects or fungi, but they usually appear when the cultivator has planted vast areas with the same kind of tree, or crowded them into a hot-house, as is the case with tomato and cucumber culture in our own country.

For this same reason, the best preventive is to plant thinly, allowing each tree as much isolation as can be spared with due regard to the yield per acre. It is satisfactory from this point of view to note that, so far as can be seen from the excellent illustrations contained in the book, it is not the practice to crowd the trees together in British Columbia. The trees depicted appear to have plenty of space around them, therefore they are exposed well on all their sides to the good influences of sunshine and air, which are conducive to healthy growth and a free cropping habit.

The evidence the book contains of the enormous help the settler in British Columbia may expect to receive from the Department of Agriculture and the British Columbia Fruit-Growers' Association should be an extra inducement to emigrants to select this country for their new home. We hope Mr. Bealby will return to the subject when he has gained further experience, for it has to be noted that he has only been engaged in the industry since 1907, a fact that may cause some to receive his recommendations with a certain amount of reserve, especially so far as they relate to yields, prices, and returns.

STEAM TABLES.

Tables and Diagrams of the Thermal Properties of Saturated and Superheated Steam. By L. S. Marks and H. N. Davis. Pp. 106. (London: Longmans, Green and Co., 1909.) Price 7s. 6d. net.

AN immense amount of painstaking work is represented by this little volume, which will, we think, be of undoubted use to all physicists and engineers who have to deal with problems involving the influence of heat upon water and steam. The two authors are connected respectively with the engineering and physical sides of the great American University of Harvard, and they have evidently formed a combination well suited for such an investigation as this. Until quite recently the only authoritative experiments over a considerable range of steam pressures and temperatures were those made by Regnault more than sixty years ago. We now have, however, the results of later experiments by Dieterici, Smith, Griffiths, Henning, Joly, Grindley, Peake,

Griessmann, Knoblauch, Thomas, and others. As the result of a careful weighing of these various experiments, the authors present the following formula connecting the total heat of one pound of dry saturated steam with its temperature (Fahrenheit):—

$$H = 1150.3 + 0.745(t - 212) - 0.000550(t - 212)^2.$$

The equation heretofore in use was $H = 1082 + 0.305t$, which may also be put in the more directly comparable form of

$$H = 1147 + 0.305(t - 212).$$

It will be seen that there is a considerable difference in form between these two statements, although as one is of the second degree and the other of the first it is not easy to tell at sight by how much they would differ over the working range. The best way of comparing them is to set the figures in the old steam tables side by side with those in the new. This we have done for each increase of 50 lb. in the pressure. The figures in brackets are those of the old tables, as taken from such a standard book as Perry's "Steam Engine," and the remaining figures are those of the tables now published.

Pressure lb./in. ²	Tempera- ture ° F. (102)	Sp. Vol. Cu. Ft. per lb. (334.2)	Latent Heat (1013)	Total Heat (1113.0)	Entropy of Steam (1.9754)
1	101.83	333.0	1034.6	1104.4	1.9754 (1.987)
50	281.0	8.51	923.5	1173.6	1.6581 (1.649)
100	327.8	4.429	888.0	1186.3	1.6020 (1.590)
150	358.5	3.012	863.2	1193.4	1.5692 (1.566)
200	381.9	2.290	843.2	1198.1	1.5456 (1.545)
250	401.1	1.850	826.3	1201.5	1.5276 (1.529)
300	417.5	1.551	811.3	1204.1	1.5129 (1.515)

It will be seen that at the ordinary steam-engine pressures of 150 to 250 lb./in.², there is very little difference between the two sets of figures, but that at lower pressures there is some variation, although in no case is it extreme. On the other hand, many calculations involve the estimation of differences of heat content, and in those cases it is essential to allow for any such corrections in the received steam tables. It is, therefore, hardly too much, perhaps, to suggest to those who have made important calculations with the old tables that they should recalculate their results on the basis of these later figures.

Anyone reading carefully what the authors are able to say in support of the figures they give must concede that their researches have produced tables based on what is probably the most accurate data procurable at the present time. The theory of the steam engine will be considerably aided thereby, and one cannot but regret that there are no tables of equal accuracy applicable to the working fluid in the internal-combustion engine.

We regret that the authors should have presented the bulk of their results in the unscientific Fahrenheit scale. All who know the pitfalls which beset the paths of students will agree that, of them all, the most common and dangerous is the elusive

"32" in the Fahrenheit scale. To have such a constant is never of any use, and its avoidance is the great merit of the centigrade scale. We should like to see these tables published throughout in the scientific temperature scale.

The book contains two sheets of very useful curves, which enable large numbers of simple problems to be solved by mere inspection. Among the illustrations given we quote the following:—

(a) A vessel of 4 cu. ft. capacity contains 0.2 lb. of water and 0.8 lb. steam. What is the pressure?

(b) What is the entropy of 1 lb. of steam at 100 lb. pressure and 450° F.?

(c) Steam of 140 lb. pressure, superheated 120° F., expands adiabatically with a ratio of expansion of 6. What are the pressure and quality at the end of expansion?

(d) Steam at 100 lb. pressure, superheated 60° F., expands in a nozzle to a pressure of 2 lb./in.². What is its final velocity?

(e) Steam in a throttling calorimeter with a pressure of 17 lb./in.², and a temperature of 265° F. The initial pressure of the steam was 100 lb./in.². What was its initial quality?

It will be admitted that the ready facility with which such problems can be solved by two simple sheets of curves is a great gain, and many workers in science and engineering will be thankful for this help.

H. E. WIMPERIS.

SNAKE VENOMS.

Snake Venoms. An Investigation of Venomous Snakes, with Special Reference to the Phenomena of their Venoms. By Dr. Hideyo Noguchi. Pp. xvii + 315. (Washington: Carnegie Institution of Washington, 1909.)

IT is now forty years since Fayer and Weir Mitchell laid the experimental foundations of knowledge of the chemical characters and physiological actions of snake venoms, their investigations being inspired largely by the desire to combat the high annual death rate from snake-bite. The study of snake venoms has, however, obtained a greater interest since the publication, about fifteen years ago, of observations demonstrating the possibility of producing a high degree of immunity in animals and proving the antitodal properties of the serum of the immunised animals. These phenomena in regard to snake venoms, having been brought into line with similar phenomena in regard to bacterial toxins especially, have been bound up with, and have contributed largely to, the elucidation of the problems of immunity which have in so many directions influenced modern medical thought. Hence there has arisen in regard to snake venoms a literature of high importance, and, from its involving scientific investigators in many countries, a literature necessarily extensive and dispersed.

As the author of this book states, there is at this time, in the English language, no single work which treats of the zoological, anatomical, physiological, and pathological characteristics of venomous snakes with special reference to the properties of their venoms. As something more than a mere summary of the position